



Framework for Coordinated Control of Distributed Energy Resources

BY

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E-RESILIENCY
Energy Reliability, Security, Stability, Resilience & Efficiency



Outline

OUTLINE

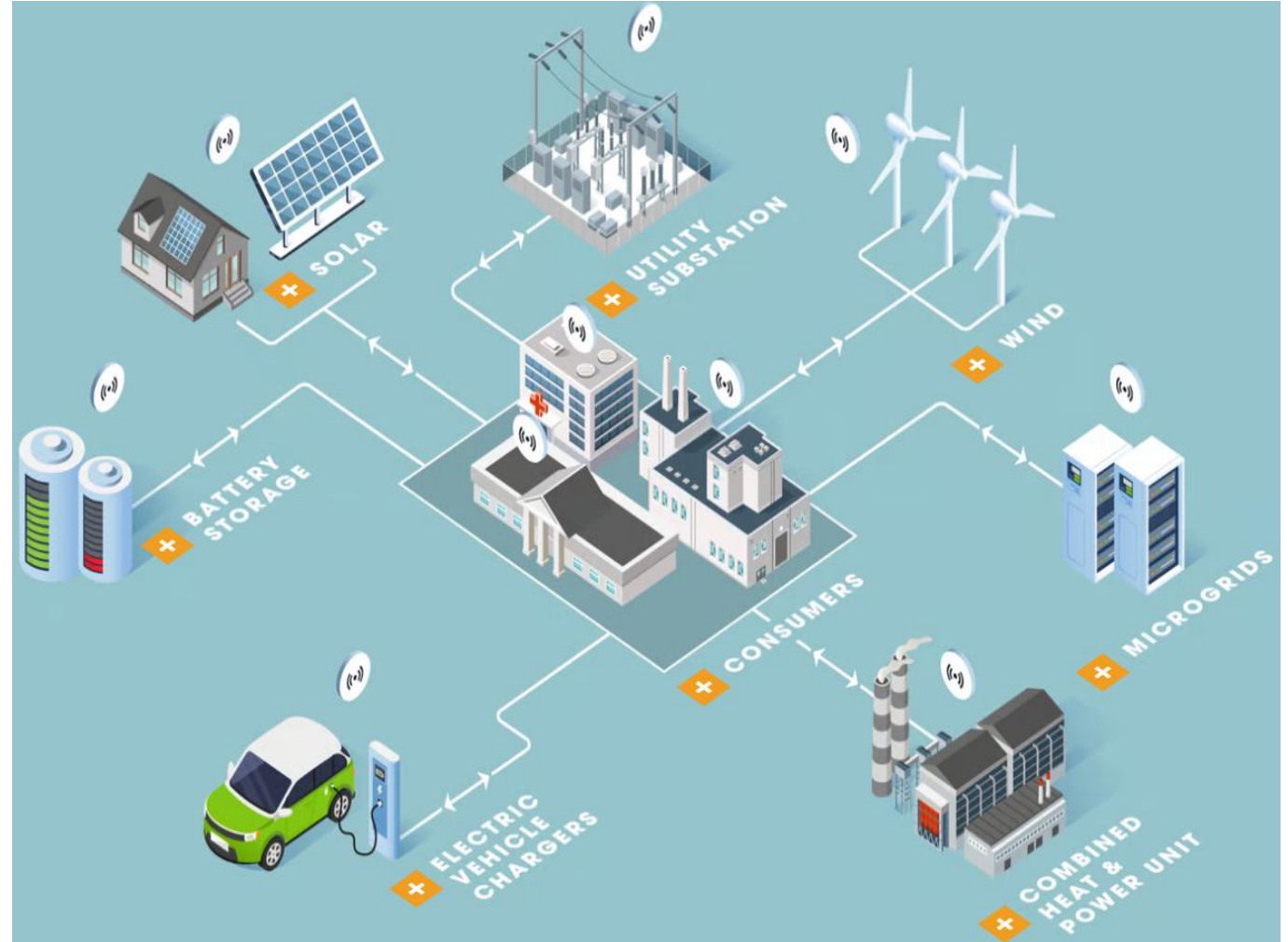
- Background
- DER Aggregations & Grid Support
- Ancillary Services
- Enabling DER Aggregation Through Cloud Computing
- Success and Challenges
- Future Work



Background

BACKGROUND

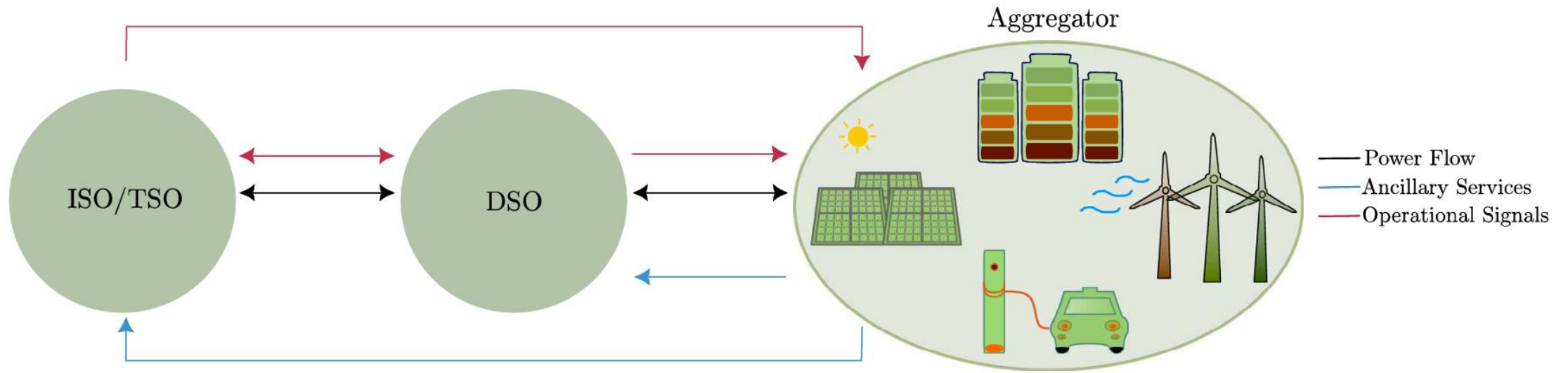
- Increased DER penetration.
- DERs replace generation, transmission, and distribution infrastructures.
- FERC order 2222 DER participate in wholesale energy markets.
- Regulatory and technical challenges.
- DER aggregation and Virtual Power Plant (VPP)





DER Aggregations & Grid Support

DER AGGREGATIONS & GRID SUPPORT

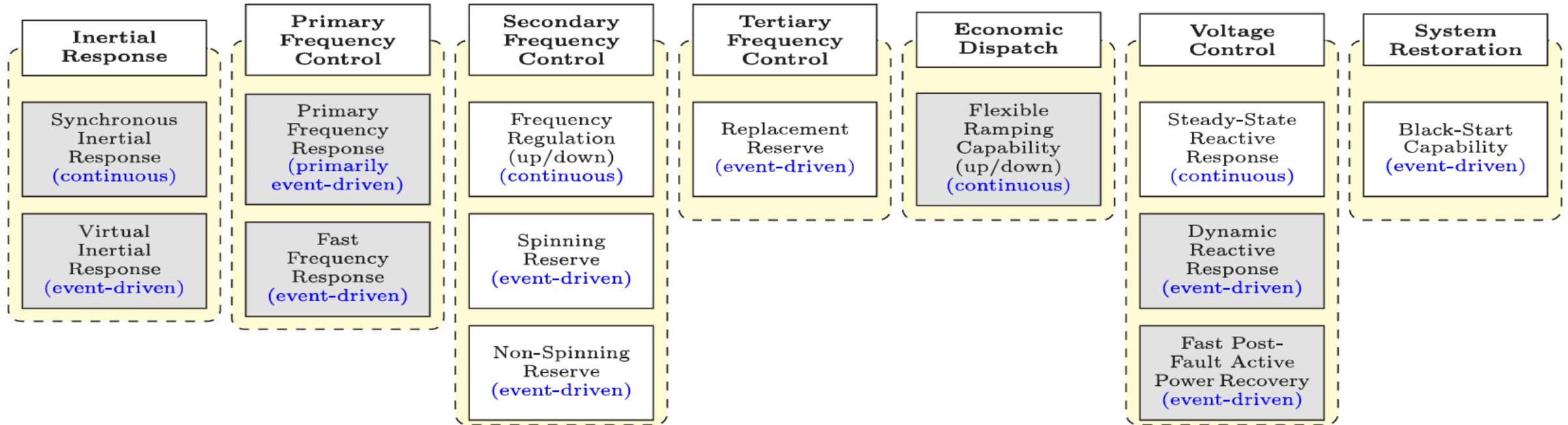


- New operation schemes and support capabilities from DERs.
- Minimum required capacity for participation in wholesale energy markets.
- Aggregators to coordinate and exchange data with DSO on behalf of DERs.
- Islanded operation capabilities and reserve potential.



Ancillary Services

ANCILLARY SERVICES



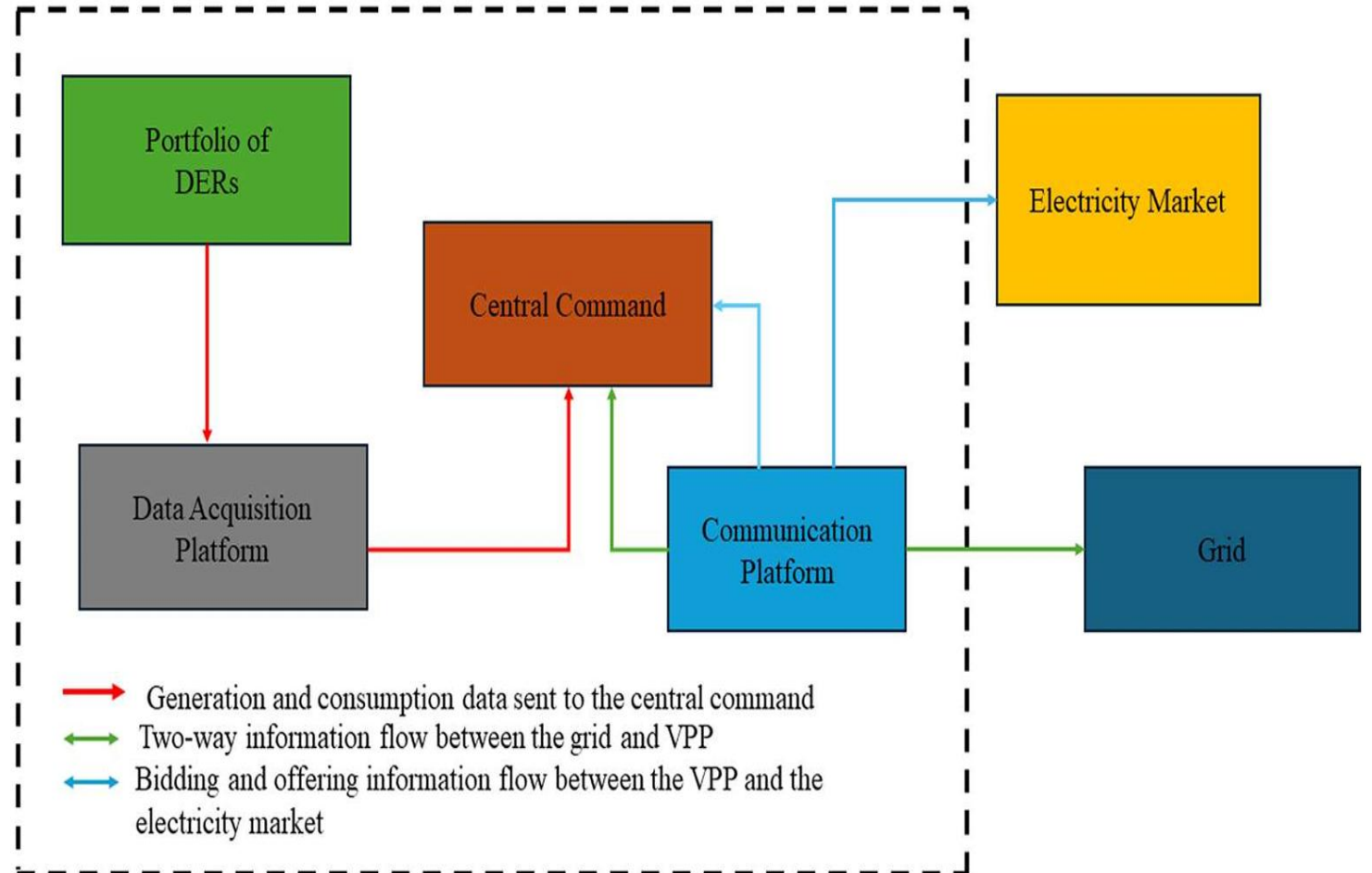
- Required generation functions to maintain uninterrupted power supply.
- DER operation uncertainty and weather dependence.
- DER role in voltage control, frequency regulation, reserve, and black start.
- Impact of consumer convenience and contradicting decisions.

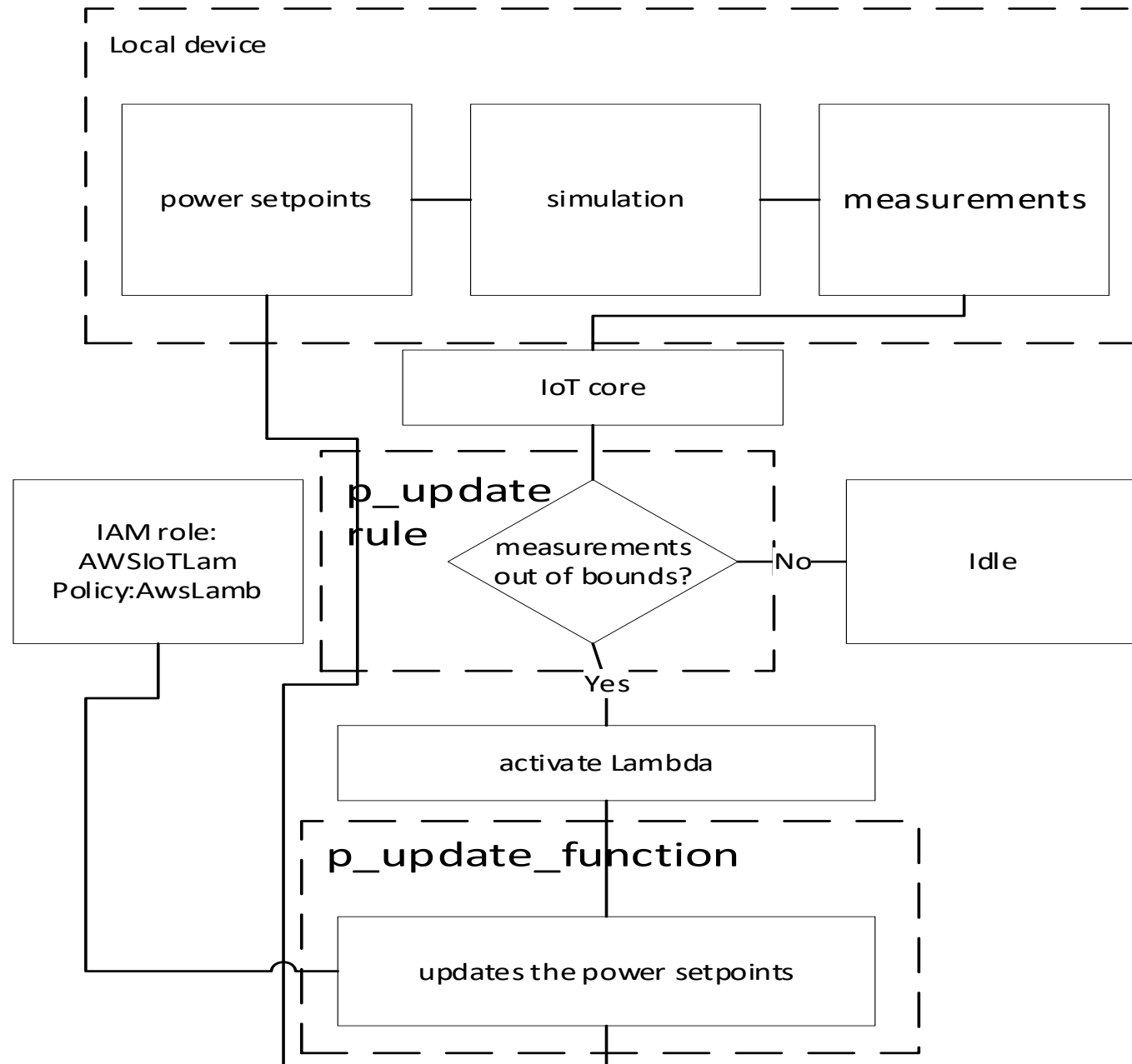


Enabling DER Aggregation Through Cloud Computing

ENABLING DER AGGREGATION THROUGH CLOUD COMPUTING

- Energy management systems to coordinate DER operation.
- Contain different DER types.
- Responds to market signal, energy demand, and grid conditions.
- Data Acquisition and Communication Platform: AWS IoT core
- System Data Storage: AWS S3
- Central Control: AWS Lambda







Success and Challenges

SUCCESS AND CHALLENGES

Success:

- Utilized AWS resources to develop a feedback control and communication system.
- Develop Lamda functions for autonomous control.
- Enable DERs to respond to market signals and provide ancillary services.

Challenges:

- Need to purchase microcontrollers for the experimental setup.
- Add more functionalities to the control algorithm.



Future Work

FUTURE WORK

- Build a Hardware in the Loop (HIL) setup on the Real-Time Digital Simulator (RTDS) using microcontrollers for DERs and AWS to provide the required aggregation features.
- Finalize the stability assessment and control algorithm.
- Test the developed algorithm using the HIL/AWS setup.
- Refine the algorithm based on the experimental results.



THANK YOU